Software Process Improvement in Automotive Domains

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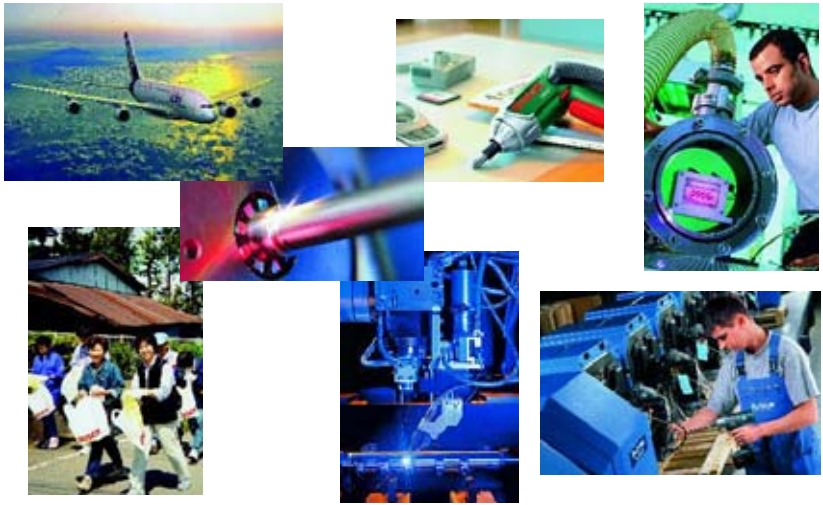

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7e SPIder Jaarconferentie
23.09.2004 Eindhoven

Software Process Improvement in de Automotive Branche: Ervaringen van Bosch

(Engelse presentatie)

Dr. Stefan Ferber
Director Corporate Systems
Engineering Process Group

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7th SPIder Conference
09/23/2004 Eindhoven, NL

Software Process Improvement in Automotive Domains: Experiences from Bosch

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Key Data

	2002	2003
Sales	35,000	36,400
Sales outside Germany as percent of total	72	71
Average number of associates	225,900	229,400
in Germany	102,700	105,600
outside Germany	123,200	123,800
Investments in tangible fixed assets	2,000	2,000
Expenditures for research and development	2,500	2,700
Net income	650	1,100

Amounts in million euros

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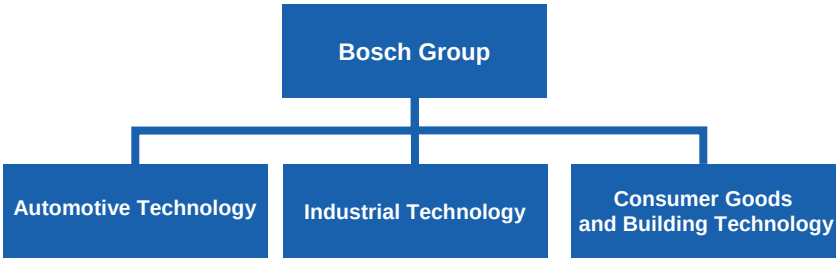
Structure of the Bosch Group

Business Sectors



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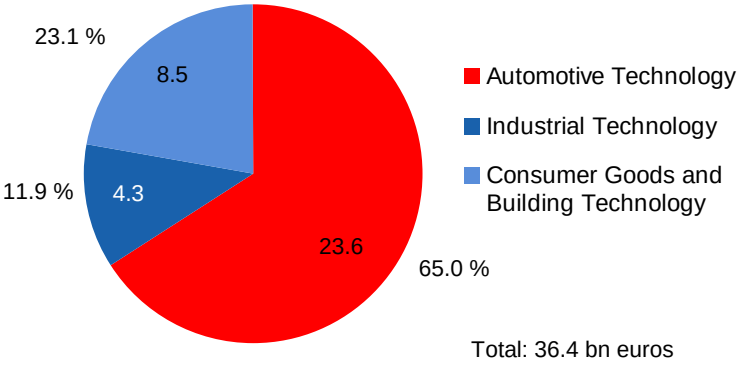
Distribution of Sales 2003

by business sector



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Automotive Technology Business Sector

Divisions

- Gasoline Systems
- Car Multimedia[1)]
- Diesel Systems
- Automotive Electronics
- Chassis Systems
- ZF Steering Systems[2)]
- Energy and Body Systems
- Automotive Aftermarket

Bosch Engineering GmbH[3)]

[1)] Blaupunkt GmbH (100 % Bosch)
[2)] ZF Lenksysteme GmbH (50 % Bosch)
[3)] Development services in the area of electronic vehicle systems

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Milestones in Automotive Technology

1897	1902	1927	1951	1967
Low-voltage magneto for vehicles	High-voltage magneto for vehicles with spark plug	Diesel fuel-injection pump	Gasoline fuel-injection pump	Electronically controlled gasoline fuel injection (Jetronic)

1976	1978	1979	1986	1991
Lambda oxygen sensor for vehicles	Antilock Braking System (ABS)	Combined digital control of gasoline injection and ignition (Motronic)	Electronic Diesel Control (EDC); Traction Control (TCS)	Controller Area Network (CAN)

1995	1997	2001	2002	2003
Electronic Stability Program (ESP); Vehicle navigation systems with voice output routing	High pressure injection system Common Rail for diesel engines	Electro-hydraulic brake (SBC)	Electronic Battery Management (EBM)	Third generation of common rail, with piezo inline injectors

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without Software

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Software Process Improvement in Automotive Domains

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with Software

Software has become a core technology. Many companies never envisioned that they would participate in Software Business.

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Bosch and Software?

- I can’t buy Bosch Software for my PC!
- I don’t buy Bosch Software in a shop!

- ... but you use it everyday

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Example: Engine Control Software

- Purpose
  - Controls air, injection, ignition, and exhaust
  - User Interface: Pedals, Cruise Control
  - Theft Control, BUS-Gateway, ...
- Size
  - 250-400 kLOC per engine
- Development Effort
  - 0.5 - 10 Man-Year per engine
  - about 1.200 engineers
- Number of Products
  - 1.000 software products per Year
  - 30.000 control units per Day

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Why Software Process Improvement?

- Strategic Reason for Software
- Business Reasons for Software
- Quality Heritage
- Business Reasons for Software PI

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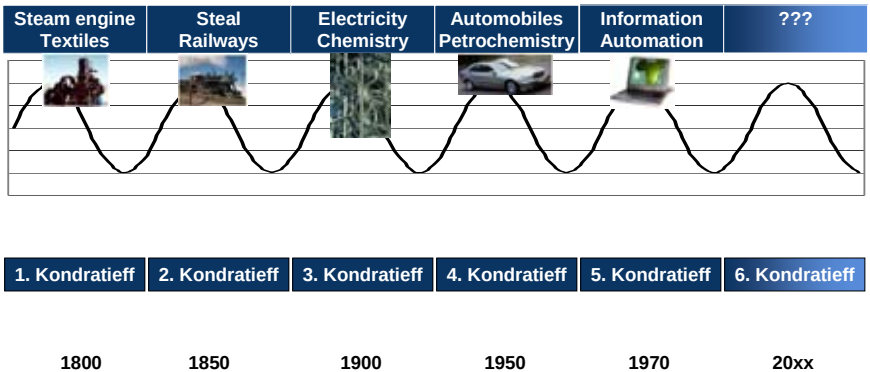
Industrial Paradigms: the Past



Source: Leo A.Nefiodow: Der sechste Kondratieff, Sankt Augustin 1999

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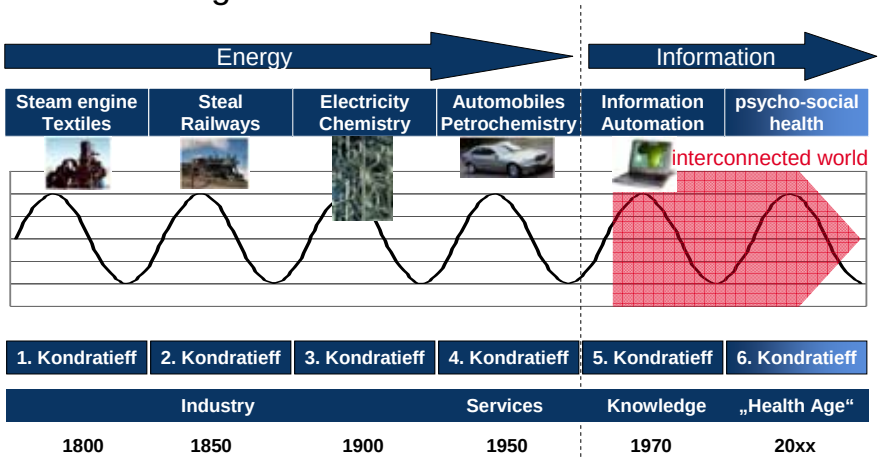
The Age of Information



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The 6th Kondratieff

- Networks of information
- Environment
- Renewable energies
- Biotechnology
- Optical technologies
- Solar technology
- Health science

Quelle: Dr. Werner Dostal (IAB)

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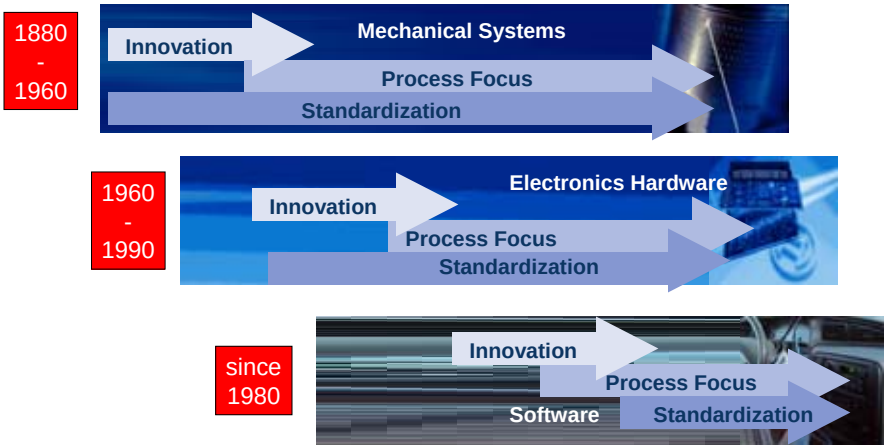
Paradigms for Automotive Innovation



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Strategic Reason for Software

- Today's Core Asset for Competition
  - Information
- (New) Bosch Core Competency
  - Information Technology
  - Software

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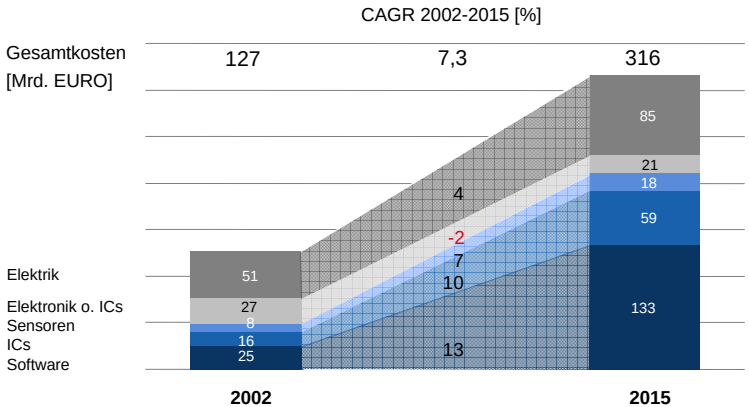
Kostenentwicklung Elektrik / Elektronik im Kfz



Quelle: Mercer Consulting, Fraunhofer Gesellschaft, Bosch

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Business Reasons for Software

- Growing Market
- Product Costs
- Product Variation
- New Features
- Shorter cycle time in development

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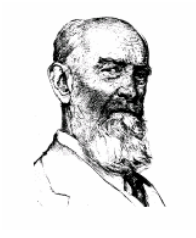
Robert Bosch's Quality Principle



It is an unbearable thought to me that while checking one of my products, somebody could show that I in some way performed inferior work. For this reason, I have always endeavored to only deliver work which will pass any objective test, work that is, so to say, the very best of the best.

Robert Bosch, 1918

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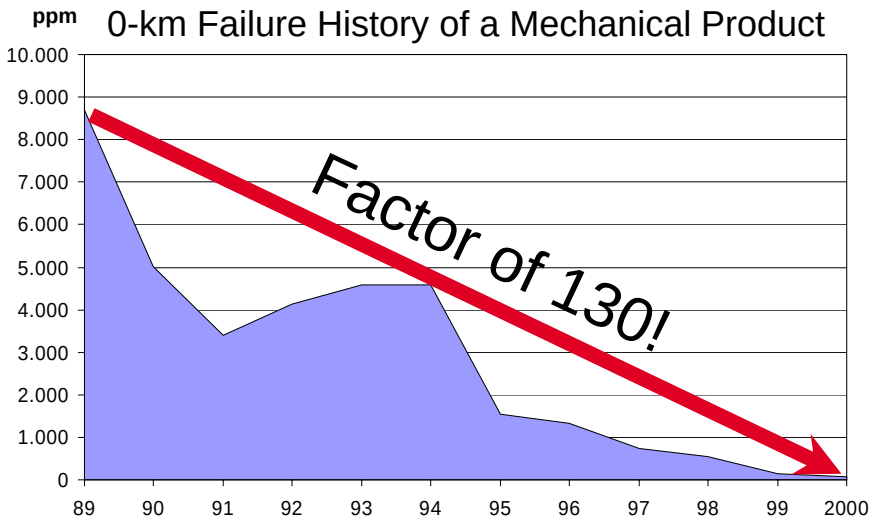

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Business Reasons for Software PI

- Product Quality
  - Quality, Reliablity, and Safety requirements:
    Software Systems must perform better (or at least meet)
    Mechanical Systems capabilities
- Development Costs
  - Strong growth in Software Engineers
- Meet customers delivery expectations
  - Time: Start-of-Production (SOP)
  - Quality
  - Functionality

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Bosch‘s Strategy

- Product Innovationen
  (Domain, Electronic, Software)
- Strategic Reuse and Architectures
- Model-based Process Improvement

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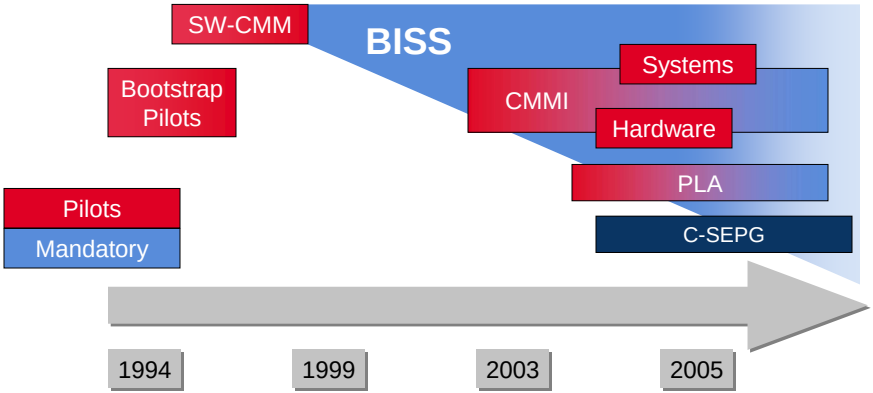
PI@Bosch on Corporate Level

BISS (Bosch Initiative for Software-Intensive Systems)



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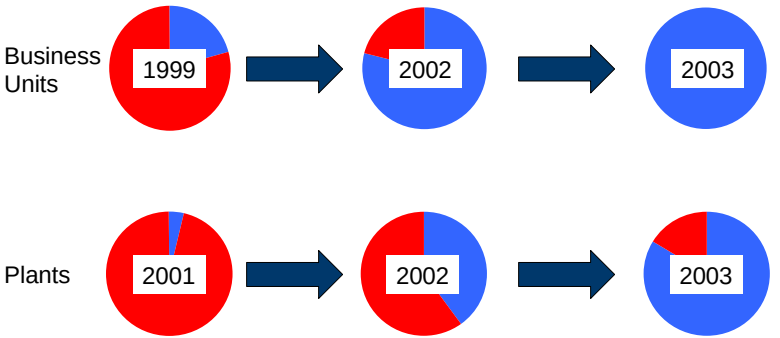
Process Improvement “Breitensport”



Bosch Initiative for Software Systems (BISS):
Number of Bosch Units that are

- within BISS
- not yet within BISS

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Status of CMM(I) Assessments (Appraisals)

- Business or Product Units
  - SW-CMM L2: 12
  - SW-CMM L3: 1
  - CMMI L3: 1
  - SW-CMM L4: 1

- Plants
  - SW-CMM L2: 10

More than 3.800 Engineers work in an organization of L2 or higher

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Success of Software PI

- Lower development costs
- More accurate project scheduling
- Increased product and service quality
- Better customer satisfaction

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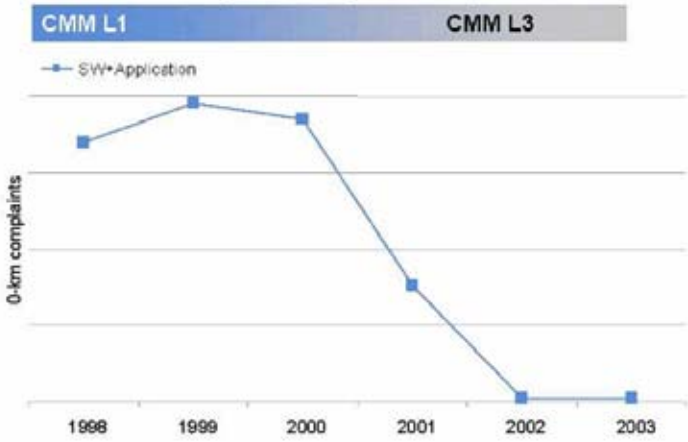
Quality Improvements



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CMMI as PI Framework

- CMMI is owned by the product development community
- Change requests from public review are inputs to the growth of CMMI
- CMMI doesn't prescribe idealistic actions; it sets realistic goals
- CMMI is interpreted and taylorable, so it complements other improvement approaches
- CMMI has been adopted by organizations in
  Australia, Canada, China, France,Germany, India, Japan, Korea, Russia, Switzerland, Taiwan, the United Kingdom, and the United States
- CMMI has a home base: Software Engineering Institute (SEI)
- Quality Control of CMMI Trainers and Appraisers

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Lessons Learned

- It takes time and energy
  - People!
  - Change Management
- Project Skills
  - Project Manager
  - Effective Teams
- Software Skills

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Our future challenges

- Lean processes, and not bureaucracy
- International & global distributed teams
- Designed processes
- From Software to Systems
- Combined Roll-Out of PLA and PI
- Software for Business
- Attract the Best: Software and Systems Engineers

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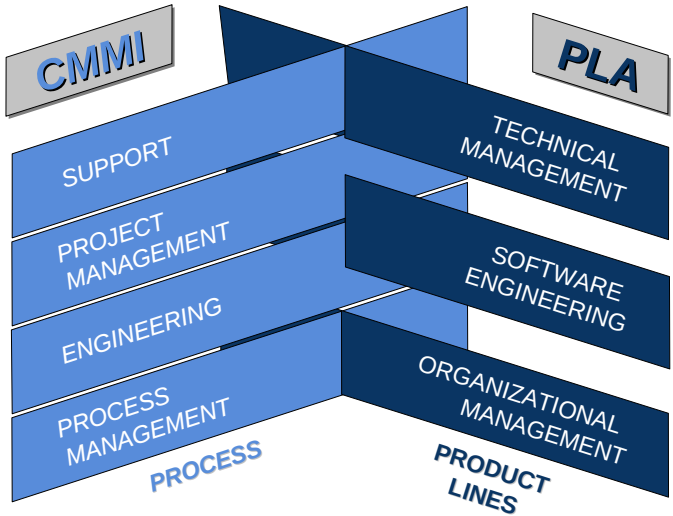

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Car without Bosch

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Questions?

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